Dose rate effects in the radiation damage of the plastic scintillators of the CMS Hadron Endcap Calorimeter

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Abstract: We present measurements of the reduction of light output by plastic scintillators irradiated in the CMS detector during the 8 TeV run of the Large Hadron Collider and show that they indicate a strong dose rate effect. The damage for a given dose is larger for lower dose rate exposures. The results agree with previous measurements of dose rate effects, but are stronger due to the very low dose rates probed. We show that the scaling with dose rate is consistent with that expected from diffusion effects.

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ERRATUM

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Erratum: Dose rate effects in the radiation damage of the plastic scintillators of the CMS hadron endcap calorimeter

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Subsequent to the publication of this paper, one of the hybrid photodiodes used as the photodetector was removed and highly localized damage on its photocathode was discovered. The study of the photodiode cathode was published in Review of Scientific Instruments 90, 02303 (2019). Because of the very localized nature of the damage, the calibration fiber readout was not affected, while the tile readout fibers were. The damage to the tile/fiber system is thus smaller than reported in this paper. As will be discussed in detail in an upcoming paper, the new dose constants increase by about a factor of 3.7 at 0.01 krad/hr. These numbers are subject to change pending collaboration review.

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